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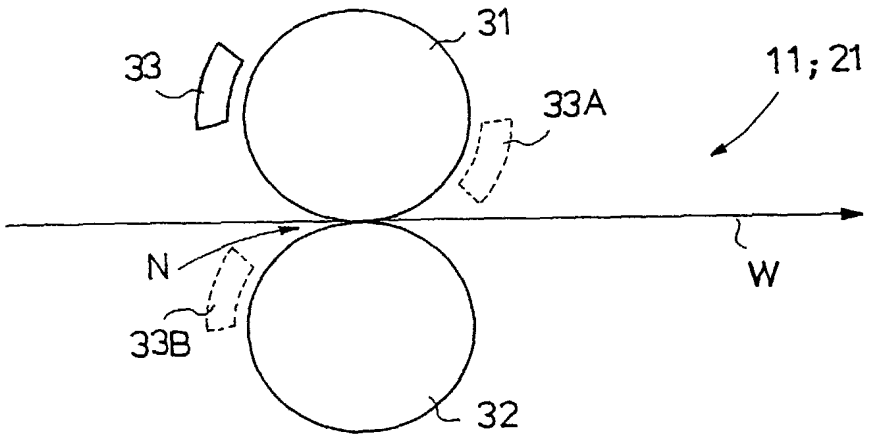
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** METHOD FOR MAKING A FIBRE, ESPECIALLY A BOARD WEB, AND CONCEPT FOR MAKING A FIBRE WEB, ESPECIALLY A BOARD EWB



(57) **Abstract:** The invention concerns a method for making a fibre web, especially board. The fibre web (W) is pre-calendered in a long-nip calender (11; 21), which replaces the Yankee cylinder. The invention also concerns a concept for making a fibre web, especially board. The concept includes a long-nip calender (11; 21) for pre-calendering the fibre web and to replace the Yankee cylinder.

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Method for making a fibre web, especially a board web, and concept for making a fibre web, especially a board web

The invention concerns a method for making a fibre web, especially a board web.

The invention also concerns a concept for making a fibre web, especially a board web.

Known in the state of the art are various methods for making a fibre web, especially board, as well as various concepts for making a fibre web, especially board. The Yankee cylinder has been a problem in making board, which cylinder has been used for drying the board and for which a replacing alternative has been sought, because the Yankee cylinder has a limited drying capacity, which limits the speed of the board machine. The surface of the board web becomes smooth in connection with Yankee drying. The smooth surface is suitable for coating.

The objective of this invention is to bring about such a method and such a concept for making a fibre web, especially board, wherein no Yankee cylinder is needed.

The invention is based on utilisation of long-nip calendering, which is known as such. In long-nip calendering it is possible to use shoe-press technology or roller/belt technology. In shoe calendering the known shoe press technology known from the press section is utilised, wherein the shoe roller includes a shoe, loading elements, a lubrication oil system and a belt. The thermo roller is technology known from soft calendering and it can be a roller heated by water, steam, oil or induction. The nip width is determined by the shoe width, and the shoe nip allows making the nip of a standard width independently of the loading, roller diameters and belt characteristics. This makes possible optimising of the

dwell time of variables important in calendering and optimising of the nip pressure independently of each other.

In belt calendering again a water, steam, oil or induction heated roller is used as well as belt circulation and a backing roller, which may be either a hard roller or a soft roller. The belt circulates by way of the backing roller and guiding/tensioning rollers, and the simple structure of the belt circulation also allows modernising of old machine calendars and soft calendars for use in belt calendering.

When using long-nip calendering to replace the Yankee cylinder in making board, the ability to profile the thickness is also required, which is not very good as such in long-nip calendering, so it is a not necessary additional objective of the invention also to bring about a method and a concept, in one advantageous application of which good thickness profiling is also brought about in the pre-calendering carried out in connection with preparation of the calendering.

In order to achieve the objectives mentioned above and those emerging hereinafter, the method according to the invention is mainly characterised in that the fibre web is pre-calendered in a long-nip calender, which replaces the Yankee cylinder.

The concept according to the invention is mainly characterised in that the concept includes a long-nip calender for pre-calendering of the fibre web and to replace the Yankee cylinder.

The method and concept according to the invention for making a fibre web, especially board, are formed by two calendering steps: pre-calendering by a long-nip calender and the actual calendering by a profiling calender, for example, either a soft calender or a machine calender. According to the invention, the Yankee cylinder is thus replaced by pre-calendering carried out by a long-nip calender,

whereby the board web is dried e.g. by ordinary drying cylinders and the surface of the board web is made smooth in the long-nip calender.

According to an advantageous application of the invention, the production line first includes a long-nip calender functioning as a pre-calender, whereupon surface sizing of the fibre web is performed, thereafter drying of the fibre web and calendering with a profiling calender and then coating. According to another advantageous application of the invention, pre-calendering by a long-nip calender is used, then a profiling calender and next coating is performed.

With the method and concept according to the invention profiling of the fibre web is achieved in the CD direction. A uniform CD profile is important e.g. for reeling of the board/paper.

According to an additional advantageous feature of the invention, the long-nip calender functioning as a pre-calender is profiled by a profiling induction heating device, whereby perpendicular profiling of the fibre web is achieved. The long-nip calender may include a thermo roller and a symbelt roller including an elastomeric belt, for example, a urethane or rubber belt. If desired, a metal belt may also be placed above the elastomeric belt or instead of this. Instead of the symbelt roller, the belt may also be mounted around the sym roller and several tube rollers to form a so-called belt calender. When profiling the fibre web perpendicularly by using profiling induction from the hottest spot, the paper is calendered more, whereby the web thickness is reduced, but the gloss and smoothness are also increased. Any resulting gloss variation in the CD direction is covered when the web is coated. The calender according to the invention provided with profiling induction may also work as a final calender with such grades where gloss variation in the CD direction is not harmful. As the diameter of the thermo roller is always big in a long-nip calender, even a small difference in the temperature will enlarge the roller diameter, which along with a long dwell time and a higher surface temperature will efficiently profile the fibre in the perpendicular direction.

In the following, the invention will be described in greater detail with reference to the figures shown in the appended drawing, but the intention is not in any way to limit the invention to the details therein.

Figure 1 is a schematic view of an application of the invention having a long-nip calender, a surface-sizing unit, a drying unit, a profiling calender and coating.

Figure 2 is a schematic view of another application of the invention having a long-nip calender, a profiling calender and a coating unit.

Figures 3A-3B show applications for a long-nip calender, which can be used for profiling the fibre web in the perpendicular direction.

In the application according to Figure 1, the fibre web is taken from the previous processing step indicated by arrow S1 to a long-nip calender 11 functioning as a pre-calender, whence the web is taken further as shown by arrow S2 to a surface-sizing unit 12, whereupon follows as shown by arrow S3 a drying unit 13 and as shown by arrow S4 then a calender 14 profiling in the CD direction. After the profiling calender 14 the fibre web is taken as shown by arrow S5 to a coating unit 15, from which it is taken further to the following processing steps as shown by arrow S6.

In the schematic application of the concept shown in Figure 2, the fibre web is taken from the previous processing step as shown by arrow T1 to a long-nip calender 21 functioning as a pre-calender, from which it is taken as shown by arrow T2 to a calender 24 profiling in the CD direction, which as shown by arrow T3 is followed by a coating unit 25, from which the web is taken further as shown by arrow T4 to the following processing step.

In the application shown in Figure 3A, the fibre web is also taken to a long-nip calender 11; 21 profiling in the perpendicular direction; where the calendering nip is formed in between a thermo roller 31 and its backing roller 32, for example, a symbelt-shoe roller. An induction heating unit 33 profiling the fibre web W in the perpendicular direction is placed in connection with thermo roller 31. Alternatively, the induction heating unit may be placed e.g. at the locations 33A shown by dashed lines, which are also close to the thermo roller, or at 33B in connection with backing roller 32.

Figure 3B shows another schematic application for a long-nip calender 11; 21 profiling the fibre W in the perpendicular direction, wherein the calendering nip N is formed in between the thermo roller 41 and its backing roller 42, which is e.g. a symbelt-shoe roller, and around the symbelt-shoe roller 42 a belt 44 is located to travel, which belt may be an elastomeric belt or a metal belt. The tensioning and guiding rollers of belt 44 are indicated by reference number 45. An induction heating unit 43 profiling the fibre web W is located in connection with the thermo roller. Alternatively, it may be located at positions 43A, 43B indicated by dashed lines.

The induction heating unit 33, 43 (33A, 33B; 43A, 43B) extends across the essential cross-directional width of the fibre web W, and when the web W is heated, the web is calendered more by its mediating action, whereby the web thickness is reduced.

Claims

1. Method for making a fibre web, especially board, **characterised** in that the fibre web (W) is pre-calendered in a long-nip calender (11; 21), which replaces the Yankee cylinder.

2. Method according to claim 1, **characterised** in that in the method after the pre-calendering performed in the long-nip calender (11) the fibre web (W) is sized on the surface, the fibre web (W) is dried in a drying unit (13), the fibre web (W) is calendered in a profiling calender (14) and the fibre web (W) is coated in a coating unit (15).

3. Method according to claim 1, **characterised** in that in the method after the pre-calendering performed in the long-nip calender (21) the fibre web (W) is calendered in a profiling calender (24) and the fibre web (W) is coated in a coating unit (25).

4. Method according to any one of claims 1 – 3, **characterised** in that the fibre web is profiled in the CD direction by a profiling calender (11; 21).

5. Method according to any one of claims 1 – 4, **characterised** in that in the method the long-nip calender (11; 21) functioning as a pre-calender is profiled by a profiling induction heating device (33; 34) for profiling the fibre web in the perpendicular direction.

6. Method according to any one of claims 1 – 5, **characterised** in that the fibre web (W) is pre-calendered in a long-nip calender (11; 21), which is formed by a thermo roller (31) and a roller (32) including an elastomeric belt.

7. Method according to any one of claims 1 – 5, **characterised** in that the fibre web (W) is pre-calendered in long-nip calender (11; 21), which is formed by a thermo roller (31) and a roller (32) including a metal belt.

8. Method according to any one of claims 1 – 5, **characterised** in that the fibre web (W) is pre-calendered in long-nip calender (11; 21), which is formed by a thermo roller (41) and a belt (44) formed around several tube rollers (42, 45).

9. Method according to claim 5, **characterised** in that the fibre web (W) is profiled in the perpendicular direction by a profiling induction heating device (33; 43) in such a way that the fibre web (W) is heated more at selected spots, whereby the fibre web (W) is calendered more and the thickness of the fibre web (W) is reduced.

10. Method according to claim 9, **characterised** in that the diameter of the thermo roller (31, 41) is profiled by a profiling induction heating device (33, 43), whereby the temperature difference will enlarge the diameter of the thermo roller (31, 41).

11. Concept for making a fibre web, especially board, **characterised** in that the concept includes a long-nip calender (11; 21) for pre-calendering of the fibre web (W) and to replace the Yankee cylinder.

12. Concept according to claim 11, **characterised** in that the concept further includes surface-sizing equipment (12), a drying unit (13), a profiling calender (14) and a coating unit (15).

13. Concept according to claim 11, **characterised** in that the concept further includes a profiling calender (24) and a coating unit (25).

14. Concept according to claim 11, **characterised** in that the long-nip calender (11; 21) is formed by a thermo roller (31) and a roller (32) including an elastomeric belt.

15. Concept according to claim 11, **characterised** in that the long-nip calender (11; 21) is formed by a thermo roller (31) and a roller (32) including a metal belt.

16. Concept according to claim 11, **characterised** in that the long-nip calender (11; 21) is formed by a thermo roller (41) and a belt (44) formed around several tube rollers (42, 45).

17. Concept according to any one of claims 11 – 16, **characterised** in that the long-nip calender includes profiling induction heating equipment (33, 43) for profiling the fibre web in the perpendicular direction.

18. Concept according to any one of claims 11 – 13, **characterised** in that the profiling calender profiles in the CD direction of the fibre web.

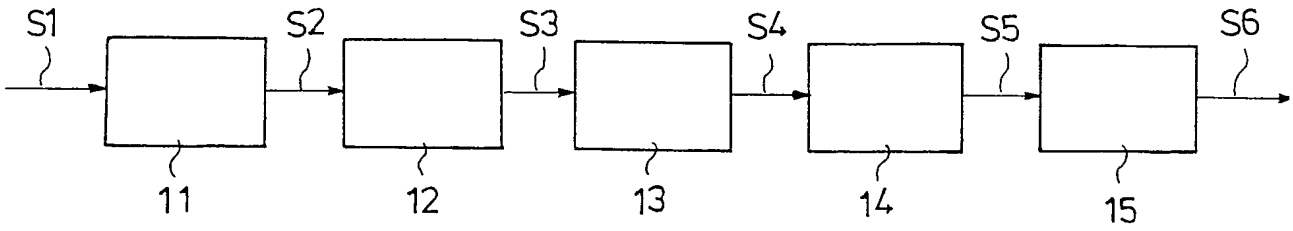

FIG. 1

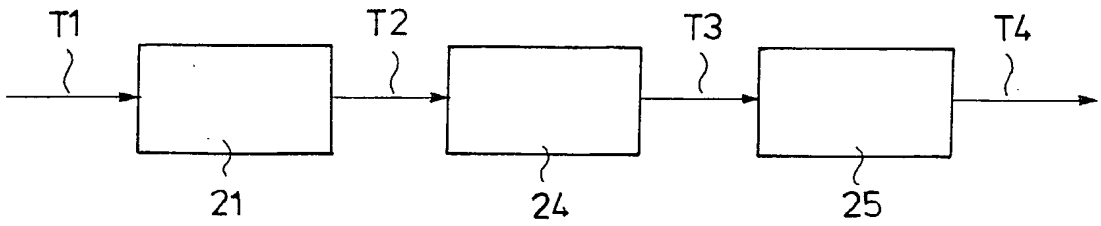

FIG. 2

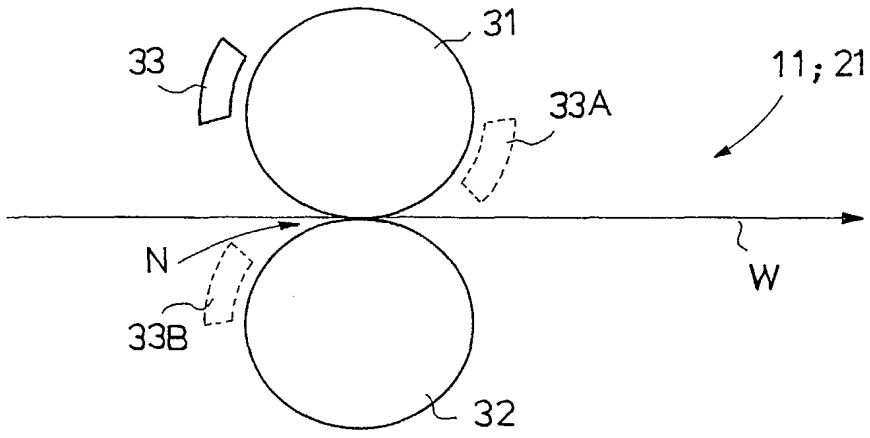

FIG. 3A

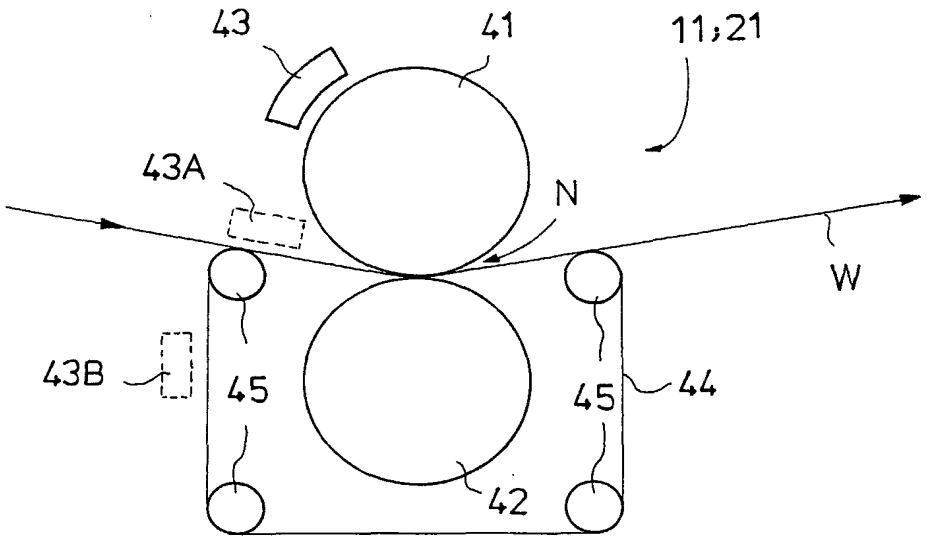

FIG. 3B

INTERNATIONAL SEARCH REPORT

Intern Application No
PC[illegible] 02/00659

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D21G1/00 //D21H19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D21G D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A		2-10, 12-18

X	WO 00 70146 A (KOIVUKUNNAS PEKKA ;LARES MATTI (FI); VALMET CORP (FI); LEINO MIKA) 23 November 2000 (2000-11-23) page 12, line 21 -page 13, line 30	1,11
A		2-10, 12-18

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 November 2002	04. 12. 02

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	OLOV JENSÉN/JA A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inter Application No
PCT/FI 02/00659

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

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Interr Application No
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PUB-NO: WO003023138A1

DOCUMENT-IDENTIFIER: WO 3023138 A1

TITLE: METHOD FOR MAKING A FIBRE, ESPECIALLY A BOARD WEB, AND CONCEPT FOR MAKING A FIBRE WEB, ESPECIALLY A BOARD EWB

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